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ABSTRACT

A survey provided a description of Internal Labor Market (ILM) practices across a sample of 694 U.S. establishments. An establishment was defined as a business address and was distinct from a company. Interviews were conducted by telephone. Findings indicated that about 35 percent of private sector establishments with 50 or more employees had achieved substantial use of flexible work organization. The adoption of these forms of work organization was correlated with three factors: being in an internationally competitive product market, having a technology that required high levels of skill, and following what could be termed a "high road" strategy that emphasized variety and quality in contrast to low cost. Employer values were also important in determining whether an establishment undertook work reorganization. Evidence was also found that certain human resource practices such as high levels of training and innovative pay systems were associated with adoption of flexible work organization. (Contains 38 references as well as definitions, and 6 data tables.) (YLB)

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HOW COMMON IS WORKPLACE TRANSFORMATION AND HOW CAN WE EXPLAIN WHO ADOPTS IT?

Results From A National Survey

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January, 1993

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Work organization and Internal Labor markets (ILMs) have captured the attention of scholars concerned with industrial performance and international competition. These researchers have seized upon the contrasts between our (stylized) views of German and Japanese firms and the traditional organization of work in America. The argument is that for American firms to become more competitive they need to transform their ILMs in the direction of a new model, a model which has been characterized by a variety of labels (e.g. "transformed" (Kochan, Katz, and McKersie, 1986), "salaried" (Osterman, 1988) "flexible specialization" (Piore and Sabel, 1984), "high commitment" (Walton, 1985), or "High Performance Work Organization." [1]

It therefore seems fair to say that a new conventional wisdom has emerged concerning work organization in America. This view holds that gains in productivity depend upon adoption of new modes of work organization, models which entail ILM innovations such as broad job definitions, use of teams, employee proble· solving groups, and quality circles. For the automobile assembly industry this is captured in the distinction between "lean" and "robust" production systems, the former characterizing both Japanese plants and innovative American efforts such as

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[1]In this paper, in order to avoid choosing terminological sides, I will use the term "flexible work organization." We will see, however, that the data suggest that there is considerable ambiguity about just what is involved in such a construct. For a very useful review of the shifting fashions in terminology and description see Bailey (1992)

NUMMI and Saturn (McDuffie, 1991). Influential national reports such as Made in America (Dertouzos, Lester, and Solow, 1989) or the Cuomo Commission (1988) have emphasized the importance of spreading flexible work organization throughout economy. Many observers believe that some American firms have indeed undertaken, or begun, this transformation while others have either chosen not to or have been unable to make the shift. A common policy prescription is that interventions such as training or incentives to adopt new work systems should be deployed by state, local, and Federal governments.

Indeed, in recent years various public policy initiatives have emerged, albeit at a small scale, which are intended to encourage the spread of these work systems. At the Federal level the Department of Commerce has created Advanced Manufacturing Centers which work with small and medium size firms in implementing elements of flexible work organization. The Baldridge Award for quality has also received considerable attention. In addition, several states such as Michigan, Ohio, Minnesota, and Indiana have either created new agencies or redirected industry extension services to spread more flexible work systems.

Running throughout this academic and policy discussion have been two major unresolved questions. How many firms are engaged in reorganizing work and what can explain which firms undertake these efforts and which do not? With respect to the first question one widely cited national estimate comes from the

Commission on the Skills of the American Workforce, which claimed that five percent of employers are so-called High Performance Work Organizations (1990). However, the Commission has never described clearly the source of this estimate. A national survey of Fortune 1000 firms by Lawler, Mohrman, and Ledford (1992) examined quality programs and a survey by Delaney, Lewin and Ichniowski (1989) examined ILM rules more generally and the results of these efforts will be compared with findings of this paper at appropriate points.[2] For specific industries Milkman (1991) provided estimates for Japanese electronics plants in California, Florida and Kenny (1991) studied auto parts suppliers in the midwest, Kelly (1989) and Keefe (1991) examined manufacturing sites using machine tools.[3]

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[2]The Delaney, Lewin and Ichniowski survey, which contained a very detailed and rich set of questions about a wide range of work practices had a response rate of 6.5%. Lawler, Mohrman, and Ledford had a response rate of 32%. The survey was limited to the 1000 largest firms and it was answered by a respondent in corporate headquarters with regard to practices for all employees in the entire company.

The survey analyzed in this paper is based on a random sample which is representative of all private sector establishments with 50 or more employees. The survey was answered at the establishment level, responses about work practices were occupation specific, and the survey had a response rate of 65.5%. More details on the survey are provided below.

[3]Milkman found that "...the Japanese owned plants in California bear little resemblance to the Japanese management model. Relatively few have quality circles or the equivalent; flexible teams are even more exceptional...only one 'Japanese practice' is more typical...most are committed in principle to avoiding layoffs. However, even this is tempered by the fact that these plants typically have high turnover rates. (pp. 79-80). By contrast, Florida and Kenney found that Japanese auto supply firms located in the midwest hew quite closely to the model and employ work teams, quality circles, and the like. Kelley and Keefe examine, among other topics, the relationship

With regard to the second question, systematic study of the determinants of adoption, the literature is extremely sparse. That is, there is little or no systematic research which takes work organization as the dependent variable and estimates models which incorporate hypotheses found in the literature. Adequate data has not hithertofore been available to take the discussion very much beyond anecdotal evidence.

As the foregoing hints, this paper employs a new survey to provide a description of ILM practices across a representative range of American industries. The main contribution of this paper is to provide some of the first representative national evidence on the distribution of new forms of work organization among American workplaces. In addition the paper seeks to explain the pattern of this diffusion by estimating a model which contains variables representing a number of competing hypotheses.

The main findings of the paper are that about thirty-five percent of private sector establishments with fifty or more employees have achieved substantial use of flexible work organization. The adoption of these forms of work organization is correlated with being in a internationally competitive product market, having a technology which requires high levels of skill, and following what can be termed a "high road" strategy which emphasizes variety and quality in contrast to low cost. Employer values are also important in determining whether an

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between the introduction of computerized machine tools and the training and skills provided to craft workers.

establishment undertakes work reorganization. There is also evidence that certain Human Resource practices, such as high levels of training and innovative pay systems, are associated with adoption of flexible work organization.

The next section of the paper describes the survey. Then I describe and model the distribution of work organization. In the final section I examine a range of human resource practices in order to determine whether they are associated, in the way that theory suggests they should be, with work organization measures.

The Survey

The survey upon which this paper is based contains 875 observations on American establishments.[4] An establishment is defined as a business address and is distinct from a company. For example, each assembly plant of General Motors is an establishment as is the corner gas station. The great advantage of establishments is that the respondent (of whom more will be said below) is likely to know the facts. I wanted to avoid the risks inherent in surveys which rely upon reports of corporate human resource personnel about practices in branch plants on the other side of the country.

The sampling universe was the Dunn and Bradstreet establishment file which purports to be a list of all establishments in the nation. In their comparison of this file

[4]After eliminating cases with missing variables and a few establishments that slipped into the survey inappropriately the final sample size used in this paper is 694.

with alternative sampling frames (the unemployment insurance files, the telephone White pages , direct enumeration, and Chamber of Commerce membership listings) Kalleberg, Marsden, Aldrich, and Cassell (1990) found that for a local area the Dunn and Bradstreet file and the unemployment insurance files yield representative samples and are the most preferred. For creating a national sample the Dunn and Bradstreet file is by far the best choice.

Considerable thought went into the selection of the respondent. While in many cases a human resources person might be appropriate I wanted to avoid an automatic selection of people in this position. The reason for the concern was that years of open ended interviews with firms suggested to me that too often HR staff, even at the establishment level, are not in touch with work organization. Therefore, the introductory letter said

> In order to get the best possible answers we need the cooperation of the most senior person at your location in charge of production of goods and services. For example, in manufacturing this might be the plant manager. In a non-manufacturing setting it might be the head of the office or the manager responsible for operations.

The interviewers worked with the establishment to identify the most knowledgeable respondent.[5]

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[5]In the end 46.0% of the respondents worked in a human resources function and 54.0% were line managers. I entered a dummy variable for an HR respondent in the equations reported below and this variable was insignificant indicating that the answers did not systematically vary with position of respondent. Recall that the sampling unit is the establishment, not the firm.

The sampling was limited to establishments with fifty or more employee in non-agricultural industries.[6] Non-profit organizations were also eliminated. The sampling was size stratified in order to create adequate samples within size categories and appropriate weights are used to create a representative sample of establishments. Each contact was proceeded by an introductory letter and a worksheet and the interviews were conducted by telephone. The response rate was 65.5%.[7]

A final point regarding the survey procedure concerns the unit of analysis within the establishment. Many variables were collected for the entire establishment. However detailed information of work organization was obtained only for CORE employees. This is because no single answer regarding say, job

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[6]According to the Dunn and Bradstreet file establishments with fifty or more employees represent just 10% of all establishments. However, according to the May, 1988 Current Population Survey they represent 51% of all employees.

[7]As already noted, this response rate is well above that of other surveys which sample a wide range of industries. It is possible to estimate response rate bias by using variables in the Dunn's file. I estimated a logit model in which the dependent variable was the probability of response and the independent variables were size, a dummy if the establishment was manufacturing, a dummy variable if the establishment was a headquarters of a multi-branch firm, and a dummy variable if the establishment was not part of a larger enterprise. The manufacturing dummy and the headquarters dummy were significant. Transforming the coefficient at the mean value of the variables indicated that the probability of response increased by 5 percentage points if the respondent was manufacturing. A similar calculation revealed that probability of response decreased by 8 percentage points if the establishment was a headquarters. However, even among non-manufacturing headquarter firms the response rate in the survey was 59.1%. The weights used in this paper are adjusted to reflect non-response.

training, is likely to be applicable to all occupational groups within a firm since firms have distinctive ILM systems for different families of jobs (Osterman, 1987). It was not practical to collect ILM data on all job families and so the notion of a CORE job was developed. The CORE job was defined as

> The largest group of on-supervisory, non-managerial workers at this location who are directly involved in making the product or in providing the service at your location. We want you to think of the various groups directly involved in making the product or providing the service and then focus on the largest group. For example, these might be assembly-line workers at a factory or computer programmers in a software company, or sales or service representatives in an insurance company.

Table I shows the distribution of the CORE job by broad occupational categories (the CORE jobs were coded as two digit occupations. This table represents a further collapsing of these categories). It is apparent, and indeed a strength of the survey, that there is considerable variation. It will be important in the analysis which follows to control for occupation.[8]

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[8]The distribution of CORE jobs by industry follows the pattern one would expect. For example, in manufacturing firms blue collar jobs were designated as the CORE job in 86.3% of the cases. In Finance, Insurance, and Real Estate the distribution of CORE jobs was 7.3% professional, 54.1% sales, 20.4% clerical, 18.0% service, and 0% blue collar.

FLEXIBLE WORK ORGANIZATION

In order to describe and analyze the distribution of more flexible work systems we must define and operationalize the idea. The problem is that there is no single accepted definition. While it seems fair to say that the many scholars who have written on the topic have the same broad set of practices in mind each author places somewhat different emphasis.

This diffuseness is replicated in the field in that firms which we might all agree are examples of flexible work organization nonetheless exhibit somewhat different practices. For example, one model is the self-directed work teams implemented in sites such as Corning and Cummins Engine and in white collar settings such as Hanover Insurance. On the other hand while the NUMMI plant has created teams and has numerous opportunities for employee involvement in quality, the actual work tasks themselves are rigidly prescribed (Adler, 1992; Brown, Reich, and Stern, 1991). It is also the case that some elements of flexible work organization, such as employee involvement and problem solving, have been incorporated---albeit with a different vocabulary--in the newly emergent quality movement.

My strategy will be to develop various measures of establishment practice. I will not insist that any single particular practice is necessary for an establishment to be classified as "flexible" but instead I will look for a mix of several practices. Second, other aspects of ILM rules--

regarding wages, employment security, and so forth--will be treated as supporting HR practices which are, as an hypothesis, necessary for the successful implementation of flexible work organization. The correlation between these supporting rules and flexible work organization will be examined in a later section of the paper.

It is also important to note that while many of the examples and the language describing flexible work systems are drawn from manufacturing the concept itself is more generally applicable. The survey included the complete range of American industries and they will be included in the analysis. However, at various points I will distinguish between the manufacturing and the non-manufacturing sub-samples.

Work Organization

In this section I examine the distribution and penetration of the work organizational practices. At the center of the new model is more flexible work organization. It is this, along with stronger employee motivation and employee input into problem solving, which is thought to create performance advantages. This flexible work organization involves moving away from rigid job classifications and into a situation in which employees are more actively involved in the production process. Having said this, however, it is also true that there is no consensus over just what the newly flexible work organization would look like.

The range of actual practices suggest that no single measure or question is likely to be appropriate in all firms. Therefore

the survey asked about four practices (all with respect to the CORE job family): self directed work teams, job rotation, use of employee problem solving groups (or quality circles), and use of Total Quality Management. For each of these the respondent was asked whether or not the practice was employed in the establishment and if so what percentage of CORE employees were involved. The precise definitions given for each practice are shown in Appendix A.

Table II shows the distribution of each practice for two levels of penetration: whether the practice is used at all and whether at least 50% of CORE employees are involved.

It is clear that if we simply ask whether or not a given practice is use among any fraction of CORE employees then we would conclude that the elements of flexible work are quite widespread. For example, over half of the establishments use teams and 33.5% of the establishments employ TQM.

The story becomes different, however, when we examine penetration. Looking at the intermediate category of fifty percent or more employees involved the rates fall sharply. Each practice falls by roughly fifteen percentage points.[9] Even so, the distribution of self-directed work-teams is surprisingly

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[9]The results of Lawler, Mohrman, and Ledford are broadly consistent with mine. They find that 56% of the Fortune 1000 firms in their sample have quality circles and that 47% have self managed work teams. In both cases the modal degree of penetration is below 20% for those firms which do have the practice (Lawler, Mohrman, and Ledford, pp. 20-22).

widespread. There is clearly some discontinuity between the extent of usage of this practice and the others.

The manufacturing/blue collar patterns are similar in that there is a substantial diffusion of the practices at any usage level and there is a drop-off when one sets a fifty percent threshold for participation. Self-directed teams appear less widespread in manufacturing than elsewhere in the economy[10] but the other practices are more common.

These data lead to the natural question of whether the practices form groups from which emerge identifiable patterns which might be thought of as the new systems discussed in the literature. Table III shows how the practices cluster together when a fifty percent penetration threshold is set (no conclusions are changed when other thresholds are imposed). It appears that there is no single major dominate cluster of practices. There is some representation for each of the possible combinations and in most of the cases the distribution of clusters seems rather even.

This conclusion changes a bit when one looks for what might be termed an "anchoring practice." Among non-manufacturing establishments whose CORE employees were not blue collar 70.9% of those establishments who engaged in at least one practice had self managed teams. Even here, however, nearly thirty percent engaged in some combination of practices which did not involve teams. By contrast, there is no evidence of an anchoring

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[10]Peter Cappelli suggested to me that this may be because self-managed work teams place strains on the inventory management system in manufacturing.

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practice among blue collar CORE employees in manufacturing. Job rotation comes closest but among those establishments who did something 55.1% involved job rotation while 44.9% had some combination which did not involve job rotation.[11]

A final question, which is virtually imposed by the popular discussion, is whether it is possible to provide a summary figure regarding the use of High Performance Work Systems. The numerous definitions in the scholarly literature might lead one to suspect that this is a difficult question to answer and nothing in these data suggest otherwise. As already noted, there is no dominate pattern.

Pushed to arrive at a definition, it might be reasonable to characterize an organization as "transformed" if there are at least two practices in place with fifty percent or more of CORE employees were involved in each. By this definition 36.6% of the entire sample, 43.0% of non-manufacturing, and 35.9% of manufacturing establishments are of the new breed. These estimates are considerably higher than those commonly cited and although the definition is admittedly arbitrary it is likely that the truth is much closer to these figures than to those found in popular accounts. However, the more formal analysis below will examine the practices independently and not attempt to force a definition upon the data.

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[11]Again, Lawler, Mohrman, and Ledford find roughly similar patterns.. For example, 64% of firms in their sample view TQM and various forms of employee involvement as distinct programs which are not jointly managed (Lawler, Mohrman, and Ledford, p. 104).

Explaining the Distribution of Work Practices

The next step is to try and understand why some establishments have adopted these various work practices while others have not. As already noted I will treat each practice as a dependent variable and that variable will be defined as the percentage of CORE employees engaged in the practice. In addition, I will estimate three models which use alternative dependent variables as measures of the establishments' overall profile with regard to flexible work systems. Details on the estimation methods are provided below.

The independent variables are intended to test many of the explanations which have appeared in the literature concerning why there is variation in the adoption of flexible work practices across establishments. These variables can be clustered in several categories:

Markets and Strategy One would expect that the nature of an establishment's competitors and of its market would influence the choice of work systems. However, the relationships are not necessarily simple and straightforward. Consider first competitive pressure. Normally, one might expect that an establishment selling in a market with many competitors will be under pressure to adopt the most productive possible work system and this may indeed lead to elements of flexible work organization. Offsetting this, however, is the consideration that new work systems represent considerable investment and firms which face very competitive market situations may be operating on

too tight a margin to undertake these long-run investments. The variable measuring the competitiveness of product markets is called COMPETIV[12].

In addition to the degree of competition in the market it is also important to consider the identity of the competitors. Much of the pressure to adopt new production systems has come from the example of foreign competitors and this would seem to be strongest for enterprises which compete in international markets. In addition to this market argument it seems reasonable to expect that establishments which operate in international markets are more likely to be exposed to new ideas and practices.[13] The variable INTERNAT is a dummy variable which takes on the value of "1" if the establishment sells in international markets.

A second aspect of an establishment's market concerns its competitive strategy. Much of the current discussion posits that employers face two broad competitive choices, one which implies competing on cost and the other in which the establishment competes on the basis of quality, variety, and service (Piore and Sabel, 1984; Cuomo Commission, 1988; Kochan and Osterman, 1991). In popular discussion the former is referred to as the "low road"

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[12]The respondent was asked whether there were many firms selling products or services which competed with the establishment, a few firms, or no such firms. The variable is coded "1" if there are many competing firms and "0" if there are no competing firms or a few competing firms.

[13]For example, in the automobile industry quality circles were included in contract language as early as 1973 but were only implemented on a wide scale after pressure from Japanese competitors became intense (Katz, 1985)

while the latter as the "high road," on the assumption that the latter carries with it the implication of more generous employment conditions (wages,etc.) and new work systems.

The survey contained a set of questions intended to distinguish among these strategies. I assigned 100 points to the goal of competing on cost and then asked the respondents to indicate how many points three other competitive strategies--quality, variety, and service--would receive for their establishment in comparison. For example, if competing on quality was twice as important to the establishment as competing on cost it would be assigned 200 points. I employ the first principle component of the three variables and this component is termed STRATEGY. Larger values of this variable imply greater use of the "high road" strategy.[14]

Technology An important aspect of technology is its complexity. It is reasonable to expect that the gains from the introduction of flexible work systems, and hence the likelihood of observing them, are greater under more rather than less complex technologies. This is measured by the variable SKLEV which takes on the value of "1" if the production process requires high levels of skill and "0" otherwise.[15]

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[14]The eigenvalue for the first component was 1.896 and the proportion of variance accounted for by this component was 63.2%.

[15]Respondents were asked to characterize the skill level of the CORE jobs on a 1-5 scale and SKLEV is coded "1" if the reply was very skilled or extremely skilled.

Values It is well known from anecdotal evidence that firms which appear to observers to be similar with respect to markets, technology, and other structural characteristics nonetheless differ considerably in the human resource practices.[16] One possibility is that the values of the firm--for example the extent to which the enterprise is seen as a community or a "family"--might be important. This consideration is given weight by the observation that Japanese employers have more of a community or stakeholder view of their enterprise than do Americans and that this helps explain various work practices (Dore, 1973 ; Lincoln and Kalleberg, 1990). Kochan, Katz, and McKersie (1984) cite management values as an important determinant of HR practices.

About fifty percent of the survey instrument contained a long series of questions about benefits, particularly work-family benefits, and with enterprise values regarding these benefits. This portion of the questionnaire was administered prior to the work organization questions which are the subject of this paper and hence the respondents' reply on values was unrelated to any suggestion which might have been implanted by the work organization section. In the context of asking about benefits the respondent was asked "In general, what is your establishment's philosophy about how appropriate it is to help

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[16]In the computer industry Data General and Digital Equipment Corporation come to mind as pairs of firms which over the years have had very different approaches. In the steel industry USX and National or Inland are examples.

increase the well being of employees with respect to their personal or family situations?" Establishments which responded (on a five point scale) that is was "very" or "extremely" appropriate are assigned "1" on a dummy variable (called VALUE).[17]

Firm Environment An increasingly common argument is that some companies fail to transform their work organization because such transformations are long-term investments with considerable upfront costs and uncertainty. Many firms, so it is alleged, face pressures from investors to emphasize short term profits at the expense of such long term investments (Porter, 1992; Jacobs, 1991). The variable HORIZON measures the extent to which the establishment feels such pressure.[18]

There are several other environmental features which may influence adoption of new work systems. Establishments which are part of larger organizations (e.g. a branch plant) may receive greater resources, information, and technical assistance in adopting flexible work organization. In addition, they may be more likely to adopt flexible work systems due to isomorphic

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[17]The distribution of responses on the five point scale was 1.7%, "not appropriate," 9.4%, "a little appropriate," 33.0% "moderately appropriate," 42.8% "very appropriate," and 12.8% "extremely appropriate."

[18]The respondent was asked to indicate on a five point scale the extent of pressure the establishment felt from investors or any larger organization of which it was part to attain short term profits at the expense of long term investments. This five point scale was recoded into a dummy variable which takes on the value of "1" if the respondent felt "very much pressure" or "extreme pressure."

processes of coercion and mimicry (DiMaggio and Powell, 1983; Pfeffer and Cohen, 1984; Baron, Jennings, Devereau, and Dobbin, 1988). A dummy variable LARGER takes on the value of "1" if the establishment is part of larger organization.

Size is likely to be related to adcption but the direction is ambiguous. On the one hand, smaller establishments have fewer resources to devote to human resource innovations. This expectation is born out by the literature on training which demonstrates clearly that smaller firms train less than do large ones (Bishop, nd.). On the other hand the literature on corporate reorganization and decentralization (as well as the policy discussion of networks) carries with it the implication that smaller establishments, which are not weighed down by the heavy hand of corporate bureaucracy, are more agile and likely to adopt new production techniques. In order to test for possible non-linear effects of size I use a step function, i.e. a series of size dummy variables. The omitted category is 100-499 employees.

The organizational sociology literature suggests that the AGE of an establishment should inversely influence its rate of adoption of innovations because organizational forms tend to be "frozen" at birth (Stinchcomb,1965). Finally, whether or not a union is present seems important although the expected direction of the effect is not clear. There is considerable anecdotal evidence of instances in which unions have opposed the kinds of work rule changes which are implied by transformed systems but

there are also instances in which unions have been cooperative and helpful in the process (Katz, 1985; Cappelli and Sherer, 1989). The net effect is an empirical question. The variable UNION measures whether employees at the establishment are covered by a union.

The models also include dummy variables for the CORE occupations and for industry.[19]

Estimation

An important difficulty is that there is no single obvious way to estimate a model explaining adoption of flexible work practices. One natural approach is to combine the practices and ask about an establishment's overall rating. This is particularly tempting since as noted, about a third of the establishments have none of the flexible work practices. I will take three approaches to an overall characterization of the establishment. First, I will estimate a logit model in which the dependent variable takes on the value of "1" if an establishment engages in at least one of the practices at the fifty percent level of penetration and "0" otherwise. The advantage is that this is straightforward and readily interpretable. The problem is that it is a bit arbitrary in that an establishment with 49%

[19]Cases were dropped in which there were missing values on the usage of any of the practices. In addition, three establishments in mining were dropped because of collinearity problems.

penetration is classified as "0." A second approach is to use principle components analysis to create a new variable which is constructed from the percentage of penetration of each of the four practices. I therefore create an index which is the first principle component of the four penetration variables and this is treated as a dependent variable. [20] The third approach is to estimate an ordered probit model in which the dependent variable ranges from zero to four, with each point on the scale representing an additional work practice at the fifty percent penetration level.

Taken together these three dependent variables seem to represent the range of ways one might think about an overall characterization of an establishment. One model (the logit) asks whether any practice is used at all at the fifty percent level, another (the ordered probit) asks how many practices are used at the fifty percent level, and the third (the principle components) treats penetration as a continuous variable and creates an index of the four practices. The advantage of these different models (as well as the advantage of examining each practice separately) is that we can see which findings are robust across specifications.

An appropriate criticism of combining the four practices is that they are not truly comparable. In addition, as we saw,

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[20] The index is .55*TQM Penetration + .43*Team Penetration + .38*Rotation penetration + .59*Quality Circle Penetration. The first principle component accounted for 44% of the variance and had an eigenvalue of 1.752.

there are no natural sub-clusters. It is therefore desirable to examine the penetration of each practice separately. Hence four equations, one for each practice, are also estimated.

Choice of the appropriate estimation method for the equations for each practice is a bit more complicated. One choice is to continue the logit models by establishing a cut-off point (say fifty percent penetration) and estimating an equation for whether the establishment passed this threshold. This, however, throws away information and is arbitrary in that it classifies as "0" an establishment with 49% penetration. It seems preferable to use the percentage penetration as the dependent variable but this is complicated by the substantial clustering at zero. It is not appropriate to estimate separate models for whether the practice is used at all and for the percentage of penetration because this leads to biased estimates in the equation for the percentages. However, the Tobit model is designed to deal with censored dependent variables of this kind (Maddala, 1983) and this is what I employ.[21]

Means for the variables are in Table IV and results of the estimation are presented in Table V. The first column contains coefficients for logit model concerning whether the establishment engages in any practices at the fifty percent level of

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[21]The dependent variable is censored in that the model presupposes an unobserved continuous latent variable which measures the prolictivity of the establishment to undertake flexible work practices. We only observe this variable when it crosses a threshold and leads to non-zero values on our measures of work organization.

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penetration, the second column contains the principle component model, the third column is the ordered probit and the next four columns contain tobit estimates for the penetration of each practice. The logit and tobit coefficients have been transformed so that they have a direct interpretation.[22]

A useful way to interpret these results is to focus upon the pattern of significance levels and signs of the coefficients before examining their magnitudes. Several conclusions come through quite strongly. Most impressive is the importance of managerial values. In all seven equations the coefficient on VALUE is positive and significant. This is especially striking given that the question was asked in the context of attitudes towards employees social and economic welfare and not in regard to specific issues of work organization. Evidently, independent of any productivity gains to be had from flexible work organization, establishments which believe that they have responsibility for employee welfare are more likely to adopt innovative work practices.

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[22]In order to interpret logit coefficients as the marginal change in a probability given a one unit change in the independent variable they need to be transformed. The transformation is and this expression is evaluated at the mean probability in the sample.

There are several choices for transforming tobit coefficients. The coefficients presented in the table represent the most intuitive of these choices: the change in the expected percent of penetration given a unit change in the independent variable. This expected penetration depends in part upon the impact of the independent variable in pushing the outcome across the zero probability threshold and, second, upon the impact of the independent variable on the value of the actual probability (penetration) given that it is positive. Maddala, 1983, pp. 159-160 presents the formulas for this transformation.

It is also striking that enterprises which sell in international markets are more likely to adopt work reform (the one equation for which this does not hold--indeed the sign is reversed--is quality circles. In general this is the worst performing equation). This result holds independently of the overall level of competition in the market. One possible interpretation of this pattern is that establishments which are exposed to international markets learn more quickly than do others about alternative work practices.[23]

The third variable which produces consistently strong results is skill level. As the skill levels required by an enterprise's technology increases so does the use of the various work organization innovations.

For the remaining variables it makes more sense to examine two clusters of equations: the two work organization equations and the two quality equations. The work organization models (along with the first three equations which combine practices) support the view that establishments which follow the "high road" are more likely to adopt flexible work practices. This variable does not, however, attain significance in the quality equations. There is a hint that smaller enterprises are more likely to adopt flexible work practices.

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[23]Casualty may run in the other direction however. That is, only firms which are productive due to their adoption of flexible work organization are able to compete internationally. In order to resolve the direction of casualty data on timing both of work reforms and entry into international markets is necessary.

On the other hand, two variables--competition and being a branch of a larger organization--are significant in the quality models. Competitive pressure has a negative impact upon adoption of quality practices while being a branch of a larger organization increases the likelihood of adoption.

These patterns of coefficients for the strategy, branch plant, and competition variables, suggest that different forces underlie the adoption of quality practices and flexible work practices. The problem, however, is that any explanation for this particular pattern of coefficients seems ad hoc. Why should the "high road" affect work organization but not quality? Similarly, any explanation about learning and resources which explains why branch plants are more likely to adopt quality programs seems equally applicable to teams. It seems most prudent, therefore, to simply note that these patterns suggest that the determinants of quality programs and work organization may differ and need to be explored further.

In none of the equations is there evidence in support of the time horizons argument, nor do the age or union status of an establishment appear to be very important.[24]

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[24]Lawler, Mohrman, and Ledford present the results of significance tests of simple (i.e. unconditional) correlation coefficients between presence of TQM and some independent variables. They find that size, manufacturing, and presence of foreign competition of positively correlated with use of TQM while unionization is negatively correlated (Lawler, Mohrman, and Ledford, pp. 97-98).

Related Human Resource Policies

This section asks whether flexible work organization is associated with the kind of supporting Human Resource practices which much of the literature implies are necessary. The view that work organization changes need to be accompanied by supporting HR practices flows from an idea found in the internal labor markets literature that groups of rules fit together logically and that one cannot, as it were, randomly adopt particular practices (Osterman, 1987). The prescriptive literature has taken a similar perspective (National Research Council, 1986). While one does not expect perfect real world adherence to these ideas (i.e. some establishments will adopt flexible work organization without adopting all of the other HR rules which the literature predicts) it is important both for theory and practice to learn whether there is indeed the kind of interrelationships among personnel rules which is predicted. I will begin by describing the kinds of supporting rules theory leads us to expect and will then examine whether these practices are associated with flexible work organization in the data.

In order to achieve the flexibility inherent in systems such as team production employees must be willing to change jobs more often and to rely less on rigid procedures governing who does what. In this survey deployment rules were measured by asking two questions. The first concerned the importance of seniority

vs. merit in promotions and the second concerned the importance of insider preference vs. outside hiring in filling vacancies.[25]

Compensation is also a central HR variable. The anecdotal evidence suggests that many firms which have moved toward more flexible work organization have accompanied the shifts in work systems with comparable changes in ILM rules governing wages. This is on the theory that when employees are given more power to determine outcomes they should have a financial stake in enterprise success. There has been an explosion of innovations in pay systems and the survey focussed on three of the most popular: the respondent was asked whether or not the establishment had in place profit sharing or bonuses; gain-sharing; and pay for skill. Separate questions were asked about each practice.[26]

A second issue concerning wages is whether the establishment paid its employees a wage premium (or what might be termed an efficiency wage).[27] New work systems typically require more

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[25]The respondents were asked to respond to the following two questions on a five point scale: "When you fill a CORE job above the entry level how important is it to give preference to someone already employed in the establishment?" and "When you do fill a CORE job with someone already employed how important is seniority in deciding who among the already employed gets the job?"

[26]The wage practice questions referred to the entire establishment,not just the CORE family. In addition, pretest results suggested that it would be too difficult for the respondent to provide information on the percentage of employees covered by each program and so these data were not collected.

[27]The question asked whether for the establishment's CORE employees there was a policy in place to pay wages which were higher, the same as, or lower than employees in comparable occupations in the same industry in the same geographic area.

commitment, effort, and discretion by employees and these are just the qualities which are alleged in the efficiency wage literature to be produced by wage premiums. In addition, to the extent that the firm wishes to be selective in hiring and establish a pool or waiting line of higher quality employees it will also pay a wage premium.

The implementation of flexible work systems would seem to require higher levels of skills than are typically afforded employees in traditional mass production systems. One would therefore expect that investments in training would be higher in transformed work systems. Three training variables are used: the first measures the percentage of CORE employees who receive formal off the job training and the second measures the percentage of CORE employees who receive cross-training (i.e. training in skills other than those used directly in their current job). The third variable concerns the value placed on skill enhancement relative to other HR goals, and this variable will be described momentarily.

Many advocates of flexible work systems have argued that firms must be prepared to provide enhanced levels of job security (Levine and Tyson, 1990; Kochan and Osterman, 1990). The logic is that for employees to be willing to give up work rules which provide them a degree of job security (in the sense of limiting the employer's ability to collapse job and hence reduce

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The variable is coded as "1" if the policy was to pay a higher wage.

employment) they must be provided employment guarantees in return. Such job security is seen as an important element of the Japanese and even German systems and a number of the new auto contracts, such as NUMMI and Saturn, have strong employment pledges. On the other hand, there have been widespread recent layoffs even in firms, such as IBM or DEC, which are thought to exemplify flexible work organization. I employ two questions concerning job security. The first is simply the reply to question about whether the establishment had made any explicit or implicit no-layoff pledge. The second is part of a series of questions asking the establishment to rank a series of human resource objectives.

As with the earlier strategy variable, respondents were asked to rank several human resource goals. The technique was to assign 100 points to the a baseline objective, in this case controlling wage and benefit costs, and to ask respondents to assign points to each of the three additional objectives of increasing employee commitment, increasing employee skill, and reducing employment levels.[28] The expectation is that the first two goals will be positively associated with flexible work systems while it will prove to be difficult to undertake these practices in the context of employment reductions.

The respondents were also asked about their use of temporary and contingent labor (a distinction was made between in-house

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[28]These are distinct objectives in that reducing cost was described in terms of wage and benefit levels, not the overall wage bill.

temporary help in which the employee was directly on the establishment's payroll and outside contractors who are on a third party's payroll. Parallel questions were asked about each category). The standard argument concerning contingent employees is that firms use them in order to buffer their core employees from the vicissitudes of the labor market. Since protection of core employees is more important in transformed work systems (both because of the higher skill level of these workers and because greater security is necessary to obtain their cooperation in flexible work) we expect to find a higher fraction of contract and temporary employees in establishments which have adopted flexible work systems. A contrary argument is that use of contingents and temps signals lack of commitment to investing in a permanent labor force.

One might also expect that in firms committed to new work systems human resource considerations are given high priority. We asked establishments how important a weight HR considerations are given when major decisions are taken by the establishment and this five point scale was recoded to take on a value of "1" if HR is "very" or "extremely" important.

Table VI shows the mean value of these HR variables for the entire sample and for two sub-groups: those establishments who engage in any of the work organization practices at a penetration level of 50% or more and those who do not. In addition the Table provides significance tests for the differences in the means between the two sub-groups. These significance tests are based

upon regressions in which the dependent variable is the HR practice in question and the independent variable is a dummy for whether the establishment has fifty percent or more penetration of at least one practice. The regressions also include controls for industry and CORE occupation.

This analysis[29], shows that a number of the HR practices are indeed related to adoption of flexible work practices. There is clear evidence that skills and training are important, indeed all three of the skill variables (percent in off the job training, percent who receive cross training, and commitment to increasing skill) are significant. In addition, two of the four pay practices are significant although neither gainsharing nor the wage premium variable prove important. Whether the establishment places high value on attaining a committed work force helps distinguish employers which adopt innovative work practices from others and this consideration receives additional indirect support by the negative and significant coefficient on the use of contingent employees. Finally, the role of the HR department differentiates the two types of establishments.

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[29]Some readers might prefer a technique such as cluster analysis to determine if the HR practices fall together in recognizable ways. Although clustering is a reasonable alternative, as a first round approach I find the strategy employed here more robust. Cluster analysis can yield numerous alternative outcomes on the same data depending upon choices of metrics or distance measures and there are no tests for goodness of fit (Nunnally, 1978, p.430). Furthermore, simple examination of the means tells us that there is no HR practice which is uniformly associated with the presence or absence of flexible work organization. Hence the notion of distinct clusters is not necessarily appropriate.

The foregoing shows that many of the propositions put forward in the HR and ILM literatures concerning the practices needed to underwrite flexible work organization are supported in the data. The biggest surprise on the negative side is that there is no evidence that employment security is important nor is there evidence that seniority vs. merit rules play a role. Both of these set of variables can be thought of as capturing various aspects of job ownership. Evidently, contrary to expectations, it is possible to introduce innovations in work practices without reassuring employees that their jobs are not at risk.[30]

CONCLUSION

We have made considerable progress in documenting the extent of the diffusion of flexible work practices and in identifying their correlates. On the positive side the findings are quite

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[30] The results presented in this paper can be compared to those of Ichniowski (1990) which is based upon the survey of Delaney, Lewin and Ichniowski (1989). He did not make the distinction used here between work practices and supporting HR policies but rather used cluster analysis to combine a wide range of practices and policies into several groups. The clustering procedure led to nine groups. These clusters included typical union firms (with, for example, strict seniority and grievance procedures), transformed firms (with flexible job design, high levels of communication between management and workers, and substantial training), and a range of intermediate forms. There were also a substantial number of firms whose rules fell into no discernable pattern. The most traditional firms constituted 13% of the sample, the most transformed 13%, 46% fell between these extremes, and 28% were unclassifiable (Ichniowski, 1990, p. 15). Comparisons between these results and mine need to be made very cautiously both because of the differences in procedure and because of the very different sampling frame and response rates.

robust regarding the impact of competing internationally, of having a high skill technology, and of worker oriented values. Also robust were the findings that neither unions nor time horizons seem to be important considerations. The findings were more mixed with respect to the other variables although quite suggestive with regard to the high road strategy and being a branch of a larger organization. We also were able to identify a set of HR practices which underwrite adoption of flexible work systems. Chief among these were innovative pay schemes, extensive training, and efforts to induce greater commitment on the part of the labor force. By contrast neither employment security nor policies on the seniority/merit frontier seem to be important.

In addition to their interest as previously unavailable descriptions of national practice these results can be read as supportive of many of the ILM theories which have emerged in the past several years concerning work reorganization. At the same time, there is another more troubling reading of these patterns. This reading emphasizes the important ways in which our expectations were not met. There did appear to be an important dividing line between establishments which did nothing and those which undertook at least one of the new practices. However, once this line was crossed the work practices did not seem to cluster together into a natural formation which one might characterize by any of the labels such as "high performance work organization" or "transformed" firm. Instead each practice was better analyzed

separately. In addition, the unimportant of some of the HR practices, particularly employment security, is quite surprising.

These anomalies invite some reconsideration of received wisdom but the implication is far from clear. One possibility is that we are observing establishments in the process of change and that after some time more practices will be adopted and the clusters we expected to find will emerge. There is some support in the survey for this idea given that 49.1% of the teams, 38.0% of the job rotation practices, 71.1% of TQM programs, and 67.9% of problem solving groups or quality circles were introduced less than five years prior to the survey.

However, considerably more dramatic interpretations are also possible. We may have been misled by a few well publicized cases. At least in the U.S. there may be many paths for work reform. In this case we will want to know much more than we do about the pros and cons of different choices. In addition, the unimportance of employment security may reflect substantial changes in the boundaries of ILMs.[31]

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[31]My colleague Chuck Sabel believes that people are constructing their careers via movement among networks of firms rather than by staying put with one employer. On the other hand, the survey asked whether the expected employment of recent employees was the same, less, or greater than in the past. Among establishments which had adopted at least one of the four practices at a fifty percent level of use 43.8% said the stay had lengthened. This compares with 34.9% for the establishments with no practice at that level of penetration. In addition, in other work (Osterman, 1993) I have shown that while there is some evidence of shortening tenure in the Current Population Survey by and large the traditional patterns have remained stable.

At the minimum, it seems to me that these data indicate that it is too early to construct "ideal types" of ILMs or "transformed" firms. We first need a considerably more textured understanding of the range of practices and the direction of change.

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APPENDIX A

The following are the definitions which the interviewers used when the respondent requested clarification.

Self Directed Work Teams Employees supervise their own work, workers make their own decisions about pace and flow and occasionally the best way to get work done.

Job Rotation Self explanatory example: In some banking firms you spend six months in the real estate division, 6 months in pension plans, etc. Simply rotating jobs.

Problem Solving Groups/Quality Circles Quality programs where employees are involved in problem solving

Total Quality Management Quality control approach that emphasizes the importance of communications, feedback, and teamwork

TABLE I

The Distribution of CORE Occupations

Professional/Managerial	14.3%
Sales	19.0%
Clerical	6.0%
Service	18.3%
Blue Collar	42.3%

TABLE II

PERCENT AT ANY PERCENT LEVEL OF PENETRATON

	All	Manufacturing
Teams	54.5%	47.7%
Rotation	43.4%	57.6%
TQM	33.5%	45.6%
QC	40.8%	46.8%
Nothing	21.8%	14.2%

PERCENT AT FIFTY PERCENT LEVEL OF PENETRATON

	All	Manufacturing
Teams	40.5%	32.1%
Rotation	26.6%	38.8%
TQM	24.5%	32.1%
QC	27.4%	31.5%
Nothing	36.0%	31.0%

TABLE III

CLUSTERING OF WORK PRACTICES
(fifty percent or more penetration)

	Entire Sample	Manufacturing/blue collar
NOTHING	36.0%	31.3%
ALL	4.8	4.75
TEAMS ONLY	14.4	5.2
ROTATION ONLY	7.0	13.1
QC ONLY	3.1	2.4
TQM ONLY	2.6	5.1
TEAM/ROTATION	4.8	4.3
TEAM/QC	4.3	3.8
TEAM/TQM	4.6	4.1
ROTATION/QC	3.0	3.7
ROTATION/TQM	1.5	4.3
TQM/QC	4.4	4.5
TEAM/TQM/QC	3.6	4.7
TEAM/ROTATION/TQM	1.2	1.0
TEAM/ROTATION/QC	2.3	3.9
ROTATION/TQM/QC	1.4	3.4

TABLE IV

VARIABLE	DEFINITION	MEAN
Union	1 = A union is present 0 = No union	.237
Age	Years since establishment founded	24.675
Competitive	1 = establishment's product market is competitive 0 = not	.619
International	1 = establishment sells in international markets; 0 = not	.311
Horizon	1 = feels pressure from investors or large organization for short-term profits; 0 = not	.219
Skill	1 = CORE job very or extremely skilled; 0 = not	.369
Larger	1 = establishment part of a larger organization; 0 = not	.660
Strategy	Principle component of points assigned to variety, service, and quality relative to cost	-.004
Values	1 = it is very or extremely appropriate for establishment to accept responsiblity for personal and family well being of employees; 0 = otherwise	.552
Size 1	1 = establishment has 50 - 99 employees	.509
Size 3	1 = establishment has 500 - 999 employees	.048
Size 4	1 = establishment has 1000 - 2499 employees	.026
Size 5	1 = establishment has 2500+ employees	.006

TABLE V

Determinants of Flexible Work Organization

(t-statistics)

	Combined Work Practices			Separate Work Practices			
	Logit; Any Practice ≥50%	Principle Components, Four Practices	Ordered Probit; No. of Practices ≥ 50%	Tobit, Percent Use of Teams	Tobit, Percent Use of Rotation	Tobit, Percent Use of TQM	Tobit, Percent Use of QC
UNION	.067 (1.211)	-.176 (1.461)	-.110 (.973)	.047 (1.323)	.037 (1.042)	-.090 (1.753)	-.015 (.346)
AGE	-.001 (1.984)	-.001 (.551)	-.001 (.738)	.0007 (1.260)	-.0004 (.746)	-.0004 (.517)	-.0003 (.390)
COMPETIV	.065 (1.431)	-.197 (1.989)	-.079 (.836)	.011 (.395)	.019 (.626)	-.103 (2.500)	-.095 (2.481)
INTERNAT	.172 (3.194)	.267 (2.338)	.330 (3.05)	.131 (3.861)	.064 (1.846)	.147 3.089	-.079 (1.761)
HORIZEN	-.017 (.347)	.066 (.587)	.026 (.248)	-.013 (.393)	-.087 (2.416)	.056 (1.196)	.060 (1.388)
LARGER	.090 (1.827)	.575 (5.371)	.441 (4.21)	.048 (1.520)	.023 (.702)	.245 (5.050)	.269 (5.955)
VALUES	.163 (3.854)	.578 (6.131)	.509 (5.56)	.105 (3.690)	.117 (3.882)	.111 (2.747)	.199 (5.223)
SKILL	.099 (1.956)	.410 (3.781)	.300 (2.92)	.113 (3.553)	.017 (.542)	.078 (1.685)	.076 (1.806)
STRATEGY	.058 (2.906)	.079 (2.378)	.108 (3.43)	.026 (2.728)	.024 (2.518)	.015 (1.075)	.003 (.276)
SIZE 1	.083 (1.767)	.264 (2.549)	.325 (3.25)	.127 (4.064)	.009 (.285)	.016 (.360)	.033 (.806)
SIZE 3	-.317 (3.254)	-.567 (2.646)	-.647 (3.06)	-.186 (2.764)	-.099 (1.472)	-.084 (.985)	-.028 (.358)
SIZE 4	.177 (1.269)	.183 (.646)	.263 (.983)	.150 (1.610)	-.012 (.129)	.052 (.452)	.331 (3.246)
SIZE 5	-.192 (.783)	-.211 (.382)	-.257 (.495)	-.159 (1.610)	-.027 (.161)	.107 (.533	.175 (.886)
CONSTANT	-.478 (3.533	-1.715 (6.126)	-.257 (.495)	-.281 (3.316)	-.171 (1.914)	-.500 (4.158)	-.619 (5.488)
Log Likelihood	-388.467	R^2=.242	-886.67	-587.45	-505.75	-481.05	-508.34
N	694	694	694	694	694	694	694

Columns 1,3,4,5,6 are transformed coefficients as described in the text and footnotes. The equations also include controls for occupation and industry.

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Significance Tests for HR Practices

	ALL	ESTABLISH-MENT HAS AT LEAST ONE FLEXIBLE WORK PRACTICE WITH 50% PENETRATION	ESTABLISH-MENT HAS NO FLEXIBLE WORK PRACTICE WITH 50% PENETRATION	t STATISTIC
Gainsharing	.137	.144	.126	.946
Pay for Skill	.304	.364	.197	"4.676
Profit-Sharing/Bonus	.447	.478	.393	"2.008
Wage Premium	.365	.376	.345	.792
HR Department Role	.541	.564	.501	"2.338
Percent in off-the-job training	.320	.375	.219	"4.838
Percent in Cross-Training	.451	.529	.314	"7.456
Employment Security Policy	.398	.394	.404	.179
Points for Increasing Skill	136.664	142.849	125.899	"2.651
Points for Increasing Commitment	191.711	199.713	177.521	"2.430
Points for Reducing Employment	80.455	80.195	80.916	.851
Percent Contingent	.076	.066	.090	"2.237
Percent Temporary	.070	.071	.070	.915
Seniority Hiring	.708	.721	.701	.474
Seniority Promotion	.303	.313	.286	.211

Note: The t statistics are based upon equations which include CORE occupation and industry controls.

" = significant difference at 1% level
' = significant different at 5% level